

Community-Based Integrated Coastal Management Strategy in Tugurejo Subdistrict, Semarang

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Abstract

Community involvement has an important role to maintain and manage the coastal area of Semarang. The involvement includes program preparation, implementation and monitoring so that the community feels responsible for the rehabilitation and maintenance of the environment. The purpose of this study is to find out how the community's strategy in integrated regional management in the coastal area of Tugurejo Subdistrict, Semarang City. Sampling/research data was conducted in the coastal area of Tugurejo Subdistrict which was determined based on preliminary observations along with satellite image studies. The research that has been conducted includes: the size of the area, the level of ecological damage, the socio-cultural and economic conditions of the local community, the participation of the community in the management of coastal areas, and the interpretation of satellite images. Analysis of ecological and geophysical data related to coastal vulnerability using the Coastal Vulnerability Index (CVI) model. The physical condition of the research location was obtained from the visual interpretation of high-resolution digital globe images in three recording times, namely 2005, 2012 and 2019, which produced 13 classes of land use. The mangrove ecosystem in the coastal area of Tugurejo Subdistrict also experienced a significant increase in area despite considerable abrasion, this can be seen from the increase in mangrove area from 2005-2012 to 10.35 ha. To realize a good and sustainable coastal area, the development of coastal areas is managed in an integrated manner. The strategies carried out include: (1) involving various elements of the community in the management of coastal areas, including government, universities, private sector, communities and NGOs, (2) carrying out the concept of wanamina,

planting mangroves in ponds and (3) conducting eco-tourism with concepts the development of sustainable tourism while still supporting environmental conservation efforts.

Keywords: integrated management, coastal area, Tugurejo, Semarang

Introduction

Semarang is the capital city of Central Java which located in the coastal area. It has a 104 km coastline stretching from the estuary of the Bodri River in Kendal Regency to the estuary of the Wulan River in Demak Regency (Wibowo, 2018). The coastal area has a diverse ecosystem, consisting of water and land which has a strategic function for the economy of Semarang.

Based on research results of Martuti et al (2018), it showed that the community has an important role in the management and improvement of coastal quality become more effective and efficient in Semarang. Based on facts that every day people interact with their environment, therefore they understand their environmental conditions. Various activities that have been conducted by community groups in managing and rehabilitating coastal quality include the manufacture of breakers (APO), also nurseries and planting of mangroves.

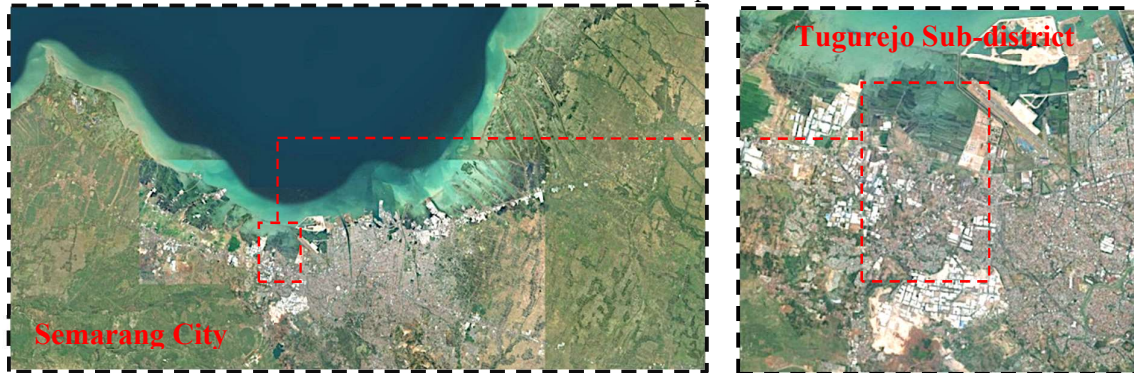
Community involvement has an important role to maintain and manage coastal areas, so that the coastal areas of Semarang are always maintained. The involvement includes program preparation, implementation and monitoring so that the community feels responsible for the rehabilitation and maintenance of the environment in order to create a sustainable coastal environment. In order to be able to effectively engage the community, it is necessary to have synergy and good communication between the

government as a facilitator and the community as actors that are very necessary to streamline the involvement of these communities (Raharjo et al, 2015).

Research on the existence and function of mangrove ecosystems in the coastal city of Semarang has been widely conducted, but no one has studied the management of integrated coastal areas in the Tugurejo Subdistrict, Semarang. Therefore, this study aims to find out how the community's strategy in integrated management of coastal region in Tugurejo Subdistrict, Semarang.

Research Method

Place and Time



Picture 1. Research Location in Tugurejo Sub-district

(Source : Digital Globe Imagery, 2018)

1) Method of Data Collection

The approach used in this study was a qualitative approach supported by quantitative data. A qualitative approach was carried out to determine the history of conversion of coastal areas and their rehabilitation, the impact felt by the population due to conversion also the actors involved in the conversion and rehabilitation of mangroves. Sampling/research data was carried out in the coastal area of Tugurejo Subdistrict which was determined based on preliminary observations along with a study of satellite imagery that showed the ecosystem in accordance with the material to be studied. Furthermore, the implementation of the research includes several things that will be the basic data of the study, which includes:

- 1) Secondary data, including the results of documentation held by the Tugurejo Subdistrict, literature studies and the results of previous research (journals, papers and information from the mass media).
- 2) Primary data obtained from interviews using questionnaires in the form of questionnaires with respondents and informants to obtain qualitative data and quantitative data.

2) Research Implementation

Location of this research activity was in the coastal area of Semarang which is focused on Tugurejo Subdistrict. The location selected due to the relatively dynamic condition of the coastal areas, such as damage to the coast in Mangunharjo Village which is in west of the research area. It severe due to abrasion which damaged farms covering an area of 96.17 ha and several houses (Situmorang and Wiwandari, 2013). Administratively, the Tugurejo Subdistrict has an area of 885.83 ha which is directly adjacent to the Java Sea in the north. The following figure presents the research location of the Tugurejo Subdistrict in Semarang. The study was conducted in May-September 2018.

In this study, several stages of research that will be carried out include:

- 1) Size of the area to be studied. Determine the size of the area to be studied in accordance with the results of the study of satellite imagery that has been presented.
- 2) Level of ecological damage. The level of damage to ex-mangrove ecosystems is seen and measured based on ecosystem damage that is no longer in accordance with its designation. Retrieval of primary data is carried out in the field by recording the level of damage of coastal areas in the Tugurejo Subdistrict. Besides that, data from observations of satellite imagery were also obtained on the condition of the study area seen in the time series for the past 5 years.
- 3) Socio-cultural and economic conditions of the local community. Socio-cultural conditions are seen based on people's livelihoods, education level, along with the social level of the target community. Besides that, the status of farm land ownership is recorded as effective forms of citizen control of land, which include: owners, tenants and cultivators (Rusdianti and Sunito, 2012).
- 4) Community participation in the management of coastal areas. The results of interviews and data collection in the field are then analyzed according to the intended objectives. The

existing data is then used to determine the participation of the community in the conservation of coastal areas.

- 5) Satellite image interpretation. One of the studies from this study was to find out the physical changes in Tugurejo Urban Village related to land use and spatial distribution of mangrove ecosystems. The data source used to obtain this information uses digital globe image data in a time series obtained from the application of google earth pro for recording 2005, 2012 and 2019. The selection of the year is more due to significant changes in regional conditions in the region, as happened in 2006 where the sea level in the coastal area of Semarang City reached 1.3 meters and projected that in 2050 there will be an increase to 4.08 meters so that the coastal areas of this city are vulnerable to abrasion and rob disasters (fauziah, 2014) The stages of image processing begin with pre-processing activities in the form of geometric corrections with the image to map method that utilizes the Rupa Bumi Indonesia (RBI) map. Digital globe imagery has a spatial resolution of 30 cm so it is very suitable for mapping areas with narrow areas with high levels of detail such as the coastal areas of the Tugurejo Village,

Data Analysis Technique

Analysis of ecological and geophysical data related to coastal vulnerability uses the Coastal Vulnerability Index (CVI) model of Gornitz et al (2001). Meanwhile, for socio-economic data and community vulnerability data analyzed qualitatively

using miles and huberman models (2007). Statistical analysis was performed to find out the different tests using ANOVA about CVI values at the study site. Data analysis using IBM SPSS 22 software, research data presented in the form of ± standard error values.

Result and Discussion

1. Coastal Region of Tugurejo Subdistrict

The physical condition of the research location was obtained from the visual interpretation of high resolution digital globe images in three recording times, namely 2005, 2012 and 2019 which produced 13 classes of land use. In general, the existing land use in the research location is dominated by ponds with an area of 323.25 ha, where the farms cultivated in the area are fish and shrimp ponds. The extent of the pond area in the area is one of the causes of abrasion, this is due to the fact that most of the pond area that exists at present is a mangrove ecosystem (Martuti et al, 2018). Another large area of land use is rice fields with an area of 68.29 ha, where rice fields cultivated in the area are irrigated with a harvest time of 2 times a year. Furthermore, there is a mangrove ecosystem with an area of 28.79 ha, the mangrove in the study area has a spatial pattern that extends on the embankment of the pond and groups adjacent to the coast and airports, where most of the mangroves are on the edge of the pond resulting in very isolated growth of the plant which impacts on plant growth cannot be optimal (Martuti et al, 2018). The following table presents the distribution of land use at the research site.

Table 1. Land Use Change Distribution in Tugurejo Sub-district 2005, 2012 and 2019

No	Land Use	Area (hectar)		
		2005	2012	2019
1	Industry	10,48	11,66	11,91
2	Road	6,99	9,09	10,46
3	Government Offices	0,13	0,13	0,17
4	Mixed Garden	6,72	10,54	8,61
5	Moor	17,29	15,19	12,63
6	Open Field	28,56	26,97	31,97
7	Field	0,77	0,77	0,77
8	Mangrove	28,79	39,14	51,80
9	Settlement	20,03	23,46	26,23
10	Public Facilities	13,67	20,82	54,86
11	Rice Field	68,29	64,77	60,68
12	River	8,89	18,94	18,86
13	Pond	403,19	369,90	323,25
	Total	855,83	855,83	855,83

Source : Digital Globe Imagery Processing, 2019

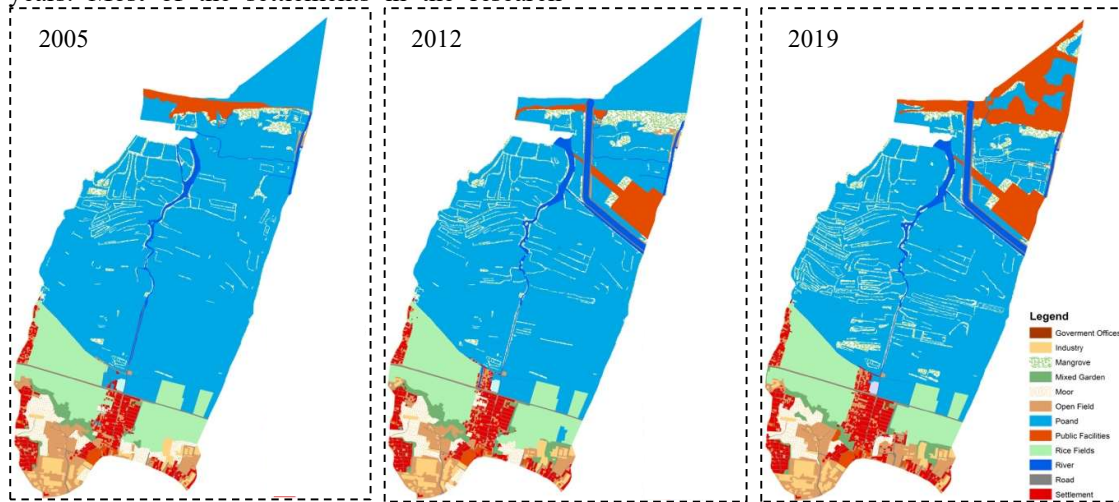
The dynamic physical condition of the research location can be seen from changes in land use that occurred as presented in Table 1.

Significant changes occurred in the pond area, where from year to year there is always a wide decline from 2005 - 2019 amounting to 79.94 ha. It was caused by abrasion which eroded pond area, besides that sea level rise also caused the pond area to become inundated, resulting in the loss of

several ponds especially those directly adjacent to the coastline, Nugraha et al (2015) stated that since 2006 - 2010 there has been a reduction in land in the waters of Tugu Subdistrict by 284 ha and in 2010 - 2014 it was reduced to 384 ha where most of the area was in the form of ponds.

While land use which has increased in area for each year is settlements, where the type of land use has increased by 6.2 ha over a period of 14 years. Most of the settlements in the research

location are in the south with a clustered pattern. The increase in residential areas in the region is more due to the increase in population, which has increased by 550 people in the period 2008 - 2019 (BPS, 2019). Increasing numbers has an impact on increasing land needs. Spatially a description of land use changes at the research location is presented in the following picture.



Picture 2. Land Use Change in Tugurejo Sub-district (Source: Digital Globe Imagery Visual Intepretation, 2019)

The mangrove ecosystem in the coastal area of Tugurejo Village also experienced a significant increase in area despite considerable abrasion, this can be seen from the increase in the area of mangrove from 2005 to 2012 of 10.35 ha and increased again to vulnerable time 2012-2019 of 12, 66 ha. The increase in the area of the mangrove ecosystem is certainly a positive thing to maintain the environmental balance of coastal areas in Tugurejo Village, considering that the mangrove ecosystem has many benefits, which besides

functioning as an abrasion deterrent, this ecosystem has a role in maintaining biodiversity, providing habitat and services ecosystem. The preservation of mangrove ecosystems in the region is a joint effort of various related parties both from government agencies or the private sector by prioritizing community empowerment programs (Martuti et al, 2018). The following figure presents the spatial distribution of time series mangrove ecosystems at the study site.



Picture 3. Mangrove Vegetation Change in Tugurejo Sub-district (Source: Digital Globe Imagery Visual Intepretation, 2019)

2. Integrated Management of Coastal Area

In order to realize a good and sustainable coastal area, the development of coastal areas

should be managed in an integrated manner between the central and regional governments, communities, universities, companies / businesses, and NGOs. Parties who have an interest in the use of natural resources in coastal areas must develop an integrated management plan that can accommodate all their interests. In the development of coastal areas, an integrated approach is needed, because the management of coastal areas has a diverse and unique ecosystem.

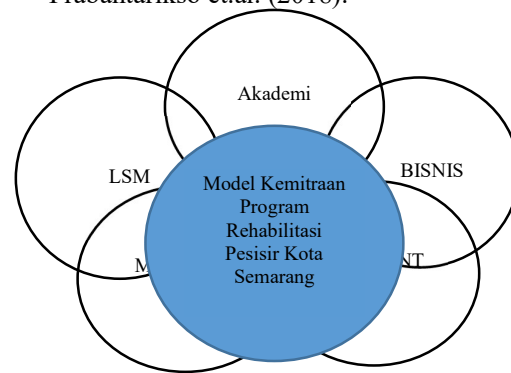
Dahuri et al. (1996) outlines four reasons that underlie the importance of integrated coastal area management, namely: first, empirically, there are ecological linkages or functional relationships, both between ecosystems in coastal areas and between coastal areas and upper land and high seas. Second, in a coastal area there is usually more than one type of natural resource, artificial resource, and environmental services that can be developed for development purposes. Third, coastal areas usually have more than one community group that has different skills or expertise and pleasure to work. Fourth, both ecologically and economically monoculture utilization of a coastal area is very vulnerable to internal and external changes that lead to business failure. Based on the results of a study in Tugurejo Urban Village, Semarang City obtained several strategies carried out by the community in improving coastal areas. These strategies include:

a. The involvement of various elements of society in managing coastal areas

Efforts to manage coastal areas to improve the coastal environment of Tugurejo Urban Village have been carried out by various elements of society, both from environmental care groups, universities, non-governmental organizations (NGOs), companies / private sector, and government agencies. Concerns about rehabilitation include planting mangroves, making APO (Waveguide), and environmental education funded by the Environment Agency (BLH) of Semarang City and Central Java Province, Semarang City Marine and Fisheries Service and Central Java Province, Diponegoro University (UNDIP), Semarang State University (UNNES), and Mercy Corps Indonesia.

The involvement of various stakeholders (multi stakeholders) in efforts to manage coastal areas in the city of Semarang shows a model of the Penta Helix partnership, which includes elements of academia, business, government, society, and NGOs. The penta helix partnership can be defined as a coastal rehabilitation model to encourage the

recovery and improvement of balanced coastal ecosystem functions through beneficial collaboration and partnerships. The program approach with the multi-stakeholder partnership model increases the potential for certainty (legality) and program success (Soesilowati et al., 2017). The penta helix partnership can be a coastal rehabilitation model to encourage the recovery and improvement of balanced coastal ecosystem functions through beneficial collaboration and partnerships (Martuti et al, 2018). Picture 4 shows the penta helix partnership model as an effort to rehabilitate coastal areas in Semarang City which were adopted from Halibas, Sibayan, & Maata (2017) and Prabantarikso et.al. (2018).



Picture 4. Multi-stakeholder participation in rehabilitation efforts the coastal city of Semarang (Martuti et al, 2018)

As done by other coastal communities, various elements / elements of the community in Tugurejo Village, Tugu District, Semarang City have made various efforts to improve coastal areas in their environment. The efforts include: nursery and planting of mangroves, the manufacture of APO from raw tires, and environmental education to the community through eco-tourism.

The condition of mangroves in Tapak Hamlet is quite good when compared to other areas around it. The results of the report of the Department of Maritime Affairs and Fisheries (2010), the lowest average density of tree-category mangroves in Tapak Hamlet, Tugurejo Village 2,500 ind / ha. Since 2000 in Tapak Hamlet, mangrove planting activities have often been carried out, both by local communities and from government, private institutions, NGOs, students and students.

b. Wanamina Concept

Mangrove planting in ponds is one of the strategies carried out in improving coastal areas while still providing economic benefits for the community. To maintain the existence of these mangroves on an ongoing basis, comprehensive protection efforts are needed through activities in the field as well as with the issuance of legislation. The regulation can be used as a legal umbrella in activities to repair coastal areas, especially planting and managing mangroves in ponds.



Picture 5. Activities to repair coastal areas by planting mangroves

Determination of the type and number of mangrove plants planted by the community of Tapak Hamlet, more based on the experience of farmers or referring to the experience of people in other areas. On fish ponds in Tapak Hamlet, some farmers planted mangroves from the *A. marina* species. *A. marina* has a fairly high tolerance limit for waters with extreme conditions such as high salinity, muddy substrate conditions, this is supported by a root system that belongs to the *A. marina* with the breath root system (pneumatofor). Besides that, *Avicennia* is a genus that has a tolerance ability to a wide range of salinity compared to other genera (Susanto et al., 2013). In accordance with the study of Budihastuti (2013) who said that *Avicennia* is the most suitable mangrove vegetation to support fish growth. Based on statistical tests

that have been done, both on milkfish and tilapia, cultural growth is better in the experimental treatment with the presence of *Avicennia* vegetation.

As stated by Kumar et al. (2011); Gautier et al. (2001), the presence of mangrove ecosystems plays an important role as a filter and natural pollution control because of the peculiarities of its root system that succeed in controlling water quality and are traps of sediments and particles carried by currents from the estuary to the ocean. This statement is reinforced by the opinion of MacFarlane et al. (2007) which states, mangrove ecosystems act as phytostabilisers which have the potential to help neutralize toxic metals from their environment.

Choosing the right type of mangrove and setting the density of mangroves is one thing that must be considered. Tapak Hamlet until 2016 there are no rules or conditions for planting certain quantities and types of mangroves in ponds. According to Fitzgerald and William. (2002), the density of mangroves should be adapted to the species of cultivation carried out, for milkfish should use low mangrove density (2000 ind / ha). For shrimp and crab cultivation, it can use a higher level of density. The implementation of the Wanamina system can provide economic benefits from the mangrove area while maintaining environmental sustainability aspects.

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higher level of density. The implementation of the Wanamina system can provide economic benefits from the mangrove area while maintaining environmental sustainability aspects.

c. Development of Ecoedutourism

Ecoedutourism is the concept of sustainable tourism development that aims to support environmental conservation (natural and cultural) efforts and increase community participation in management, so as to provide economic benefits to the community and local government and provide opportunities for the present and future young generation to utilize and develop it (UNESCO, 2009; Sudiarta, 2006). The use of mangrove ecosystems for the concept of tourism (ecotourism) is in line with the shifting interest of tourists from old tourism, namely tourists who only come to travel without any element of education and conservation to become new tourism, namely tourists who come to tour in which there are elements of education and conservation (Umam et al, 2015).

The existence of mangrove eco-tourism is expected to be able to introduce and provide education to the community about the important role of mangroves for the coastal region. As stated by Umam et al. (2015), mangrove eco-tourism has become a means of mangrove conservation in the coastal area. This can be done with a program of planting mangrove seedlings carried out by tourists. This planting movement can preserve mangrove forests while protecting the coastal ecology.

5	Dangerous Biota				√
6	Water Quality				√
7	Area Status			√	
8	Environment Threat				√

Based on the matrix, it could be seen that in ecological feasibility the Tugurejo Exit location has a tendency for tourism activities. However, several aspects, such as improvements to parking lots, toilet quality and the status of the area must be managed properly. To improve the implementation and facilities in the development of tourism that will be developed, it is necessary to have good cooperation and synergy between managers (communities), the private sector and the government.

In order to prepare for eco-tourism activities in their environment, the community has formed a tourism eco-manager in the Pokdarwis (Tourism Awareness Group) institution of the Sustainable Site Development Agency. The Pokdarwis manages its members in welcoming tourists present in the Tapak area to do tours and learn about mangroves. To support the eco-tourism, various supporting facilities such as road infrastructure and the provision of clean water have been prepared through community self-help, as well as the presence of government and private assistance. Currently the community has also been able to make various kinds of processed food made from local potential as a typical food of the Tugurejo region, such as the brain and milkfish presto, dawet and brayo sticks, and fish crackers.

Table 2. Ecological Feasibility Analysis of Tugurejo Region

No	Element of Ecotourism	Rating Category			
		Very Good	Rating Good	Medium	Low
1	Mangrove covering		√		
2	Mangrove diversity		√		
3	Fauna Diversity		√		
4	Uniqueness			√	

Table 3. Socio-economic feasibility and ecotourism development

No	Element of Ecotourism	Rating Category			
		Very Good	Rating Good	Medium	Low
1	Community institution		√		
2	Accessibility	√			
3	Clean water facilities and environmental sanitation			√	

4	Infrastructure and electricity conditions	√			
5	Parking area			√	

Socio-economic feasibility and the development of ecotourism in Tugurejo Treadmill in Semarang City have a decent and good tendency (Table 3). However, one thing that needs to be addressed is clean water and environmental sanitation facilities. As a tourist location the presence of clean water for MCK activities and parking lots is very necessary and a priority.

Conclusion

Based on the results of studies that have been conducted, the resulting conclusions are: the people of Tugurejo Urban Village, Semarang City have carried out strategies in managing coastal areas. The strategy is carried out by (1) involving various elements of the community in managing coastal areas, (2) carrying out the concept of wanamina, by planting mangroves in ponds and (3) conducting eco-tourism with the concept of developing sustainable tourism while supporting environmental conservation.

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